Inversion methods in shear elastography

Authors:

- Ana Carpio, Universidad Complutense (ana_carpio@mat.ucm.es)
- Elena Cebrián, Universidad de Burgos (elenac@ubu.es)

Abstract:

We propose an object-based Bayesian full-waveform inversion procedure with topological priors for shear wave elastography of tissues [1]. Given the observed data, we are able to produce educated prior information on the number, location, and size of nodules by topological energy methods [1, 2]. Parameterizing the nodules as star-shaped objects with a distinctive shear modulus, we introduce a low-dimensional inverse Bayesian formulation for the unknown random fields [1, 3, 4] in terms of a forward model of wave propagation. Sampling the resulting posterior distribution by Markov Chain Monte Carlo techniques we obtain ranked high probability configurations (shear moduli and shapes) for possible nodules in different tissue configurations. The uncertainty range about the highest probability shear moduli helps us to decide about the nature of the nodules and the convenience of further studies. When the posterior distribution has a single mode, the process can be speeded up by a fast optimization scheme to calculate the maximum a posteriori estimate representing the most likely parameter values [5].

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